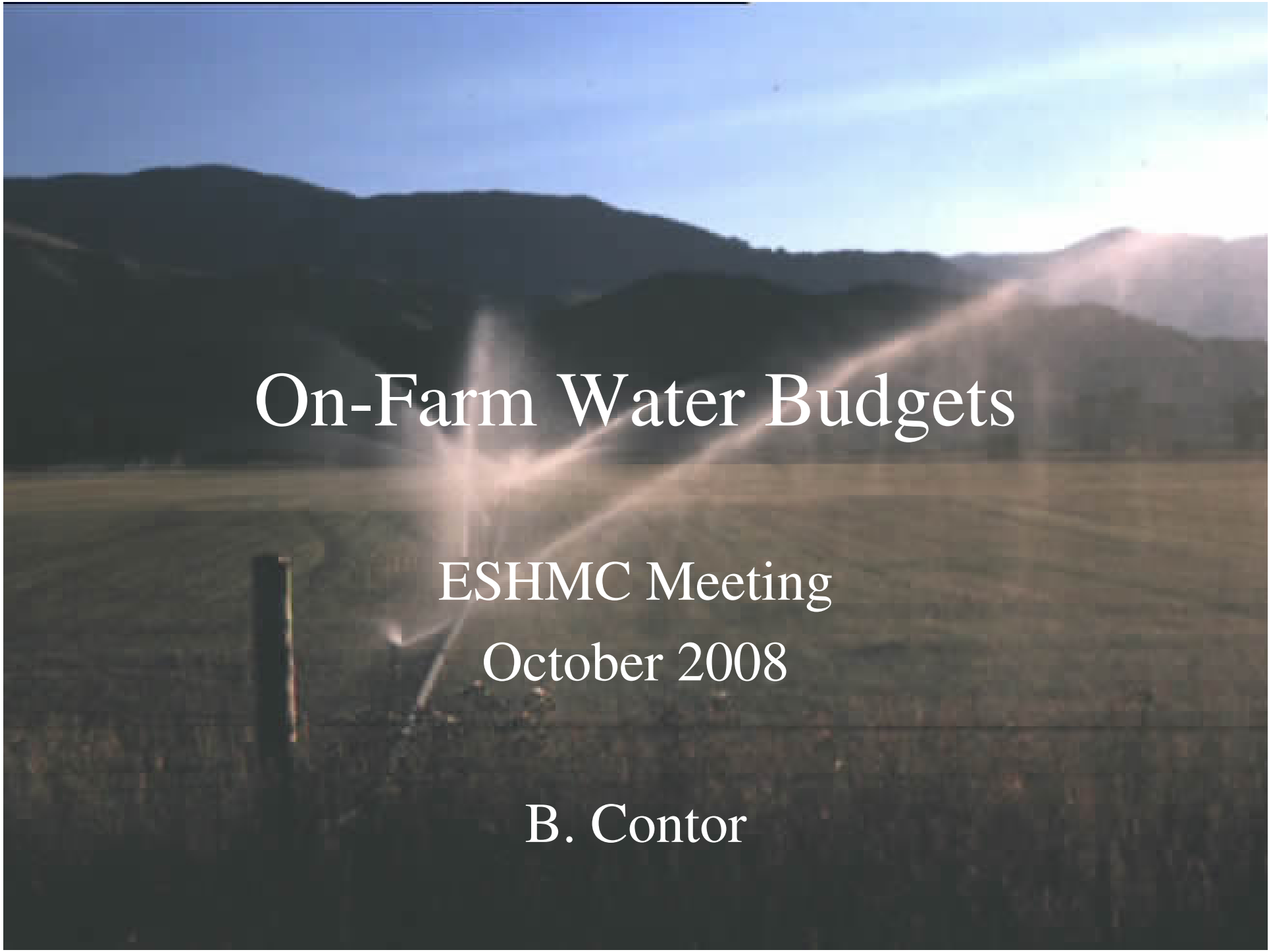


On-Farm Water Budgets

ESHMC Meeting

October 2008

B. Contor

Disclaimer:

All illustrations are hypothetical cartoons.

I believe they are conceptually accurate.

The concern

- ESPAM1.1 irrigation calculations use simple algorithms
- Implicit relationships are stepwise linear
- Only three possibilities:
  - supply > ET: Recharge
  - supply = ET: Nothing
  - supply < ET: Pumping
- Recharge is the same for all parcels in a given class (and all parts of a single parcel)

Reality Check

28 Oct 2008

Let's Examine the Simplifications

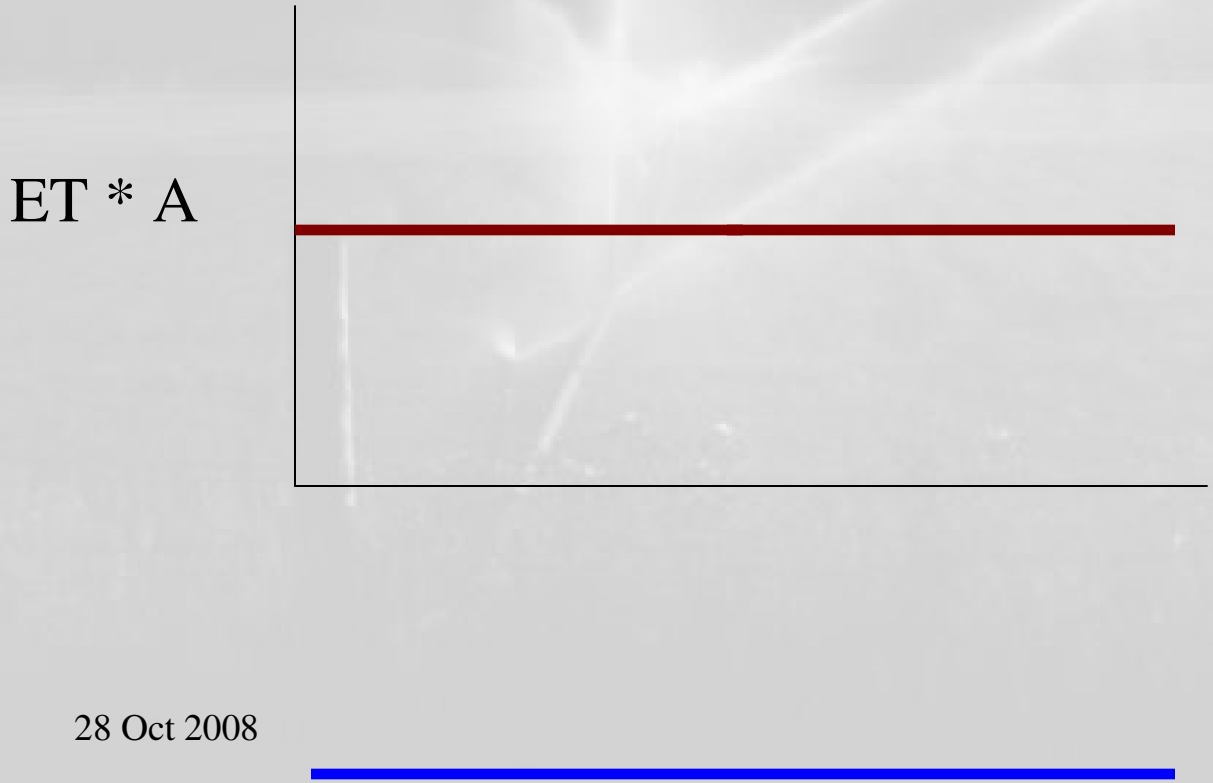
- What are our algorithms?
- What is reality?
- How much difference does it make?
- How often does it matter?
- Is there something we can do?

ESPAM1.1 conceptual model (ground water only):

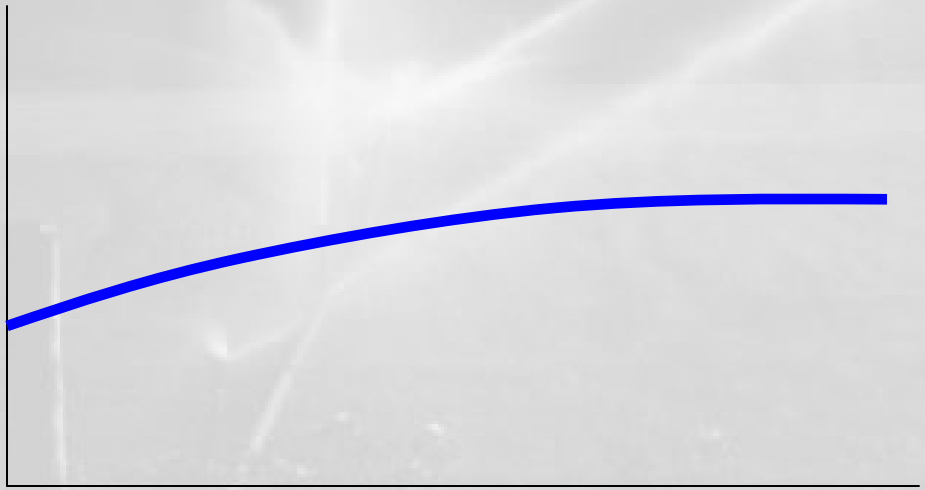
In-field Recharge = (P - ET*A)

P = precipitation
ET = Evapotranspiration
A = ET adjustment factor

ESPAM1.1 conceptual model (ground water only):



What is reality - ground water only?



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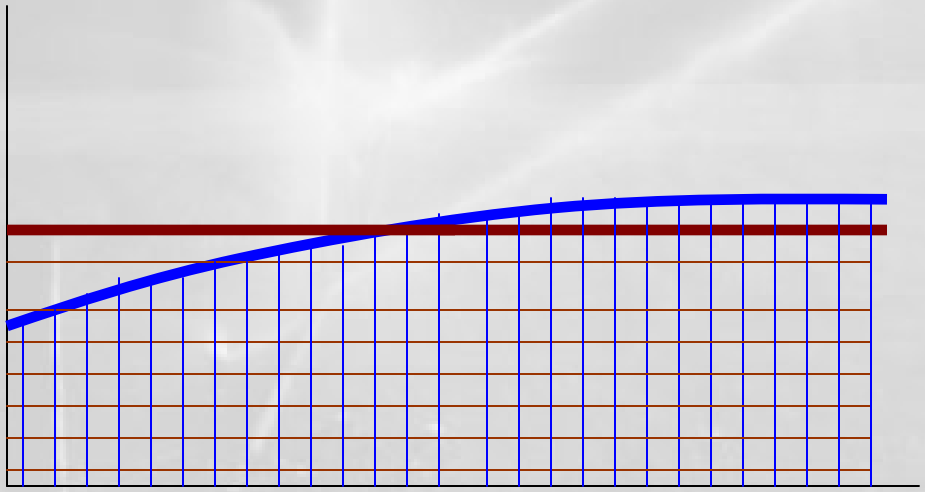
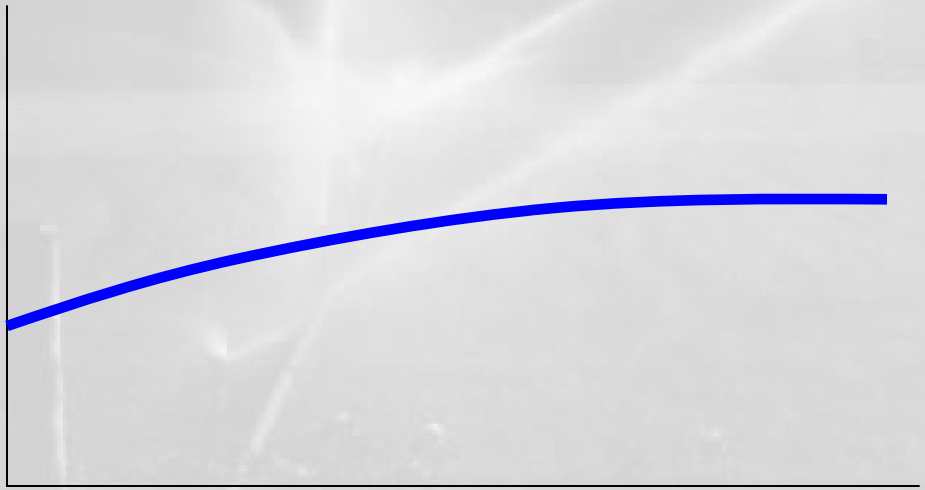
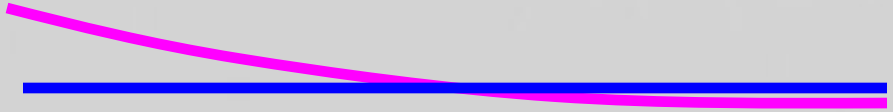


By the very construction of ET Adjustment Factors, the integrated areas under the curves will be equal.

How much difference does it make - ground water only?





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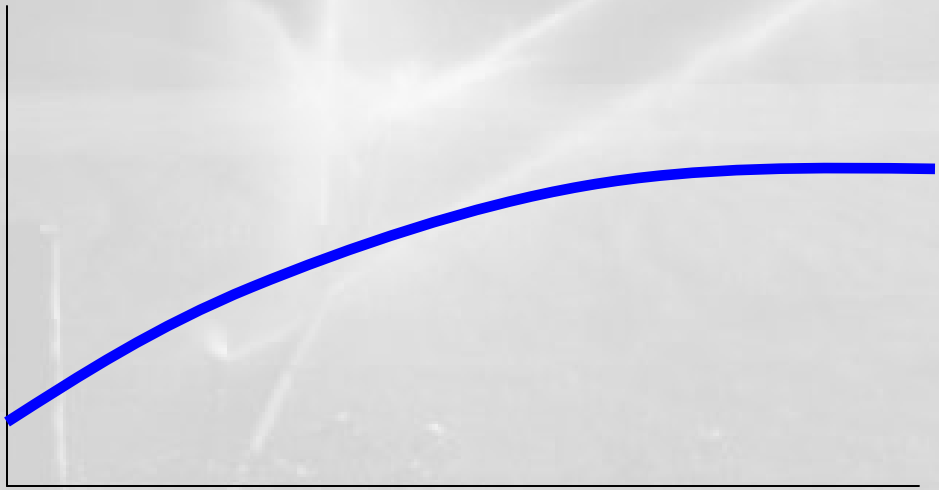
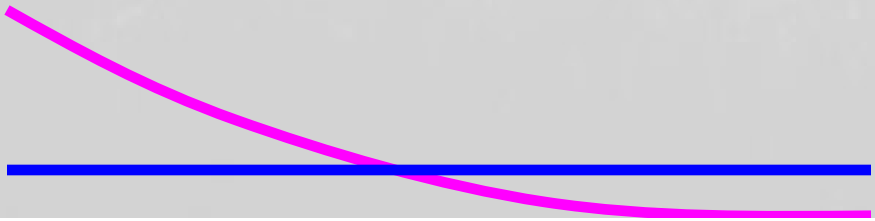




How often does it make a difference - ground water only?

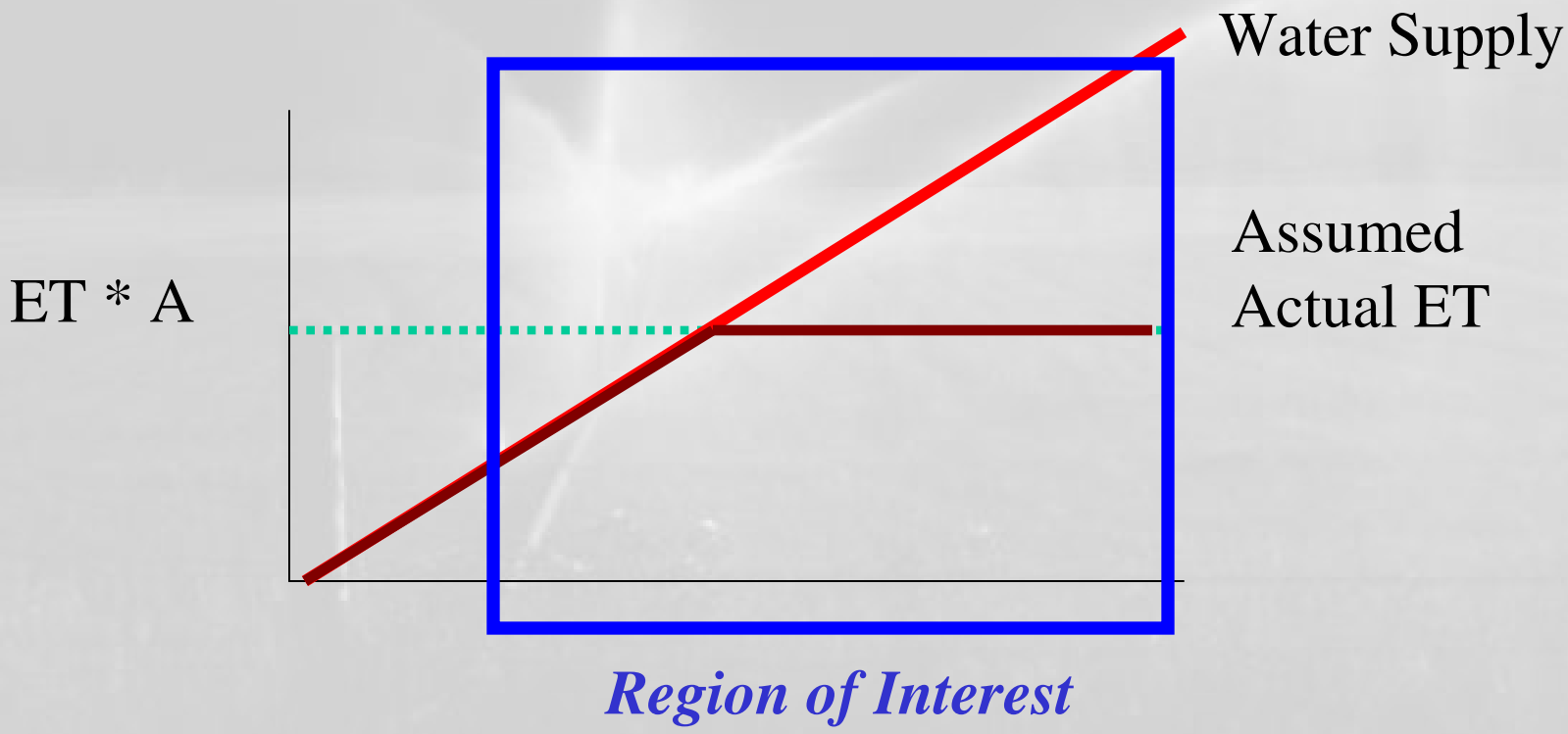
ESPAM1.1 conceptual model (surface water only):

In-field Recharge = Max* $(P + D_h - R - ET*A, 0)$

P	= precipitation
D_h	= field headgate delivery
R	= runoff from field
ET	= Evapotranspiration
A	= ET adjustment factor

* (manual adjustment)

ESPAM1.1 conceptual model (surface water only):



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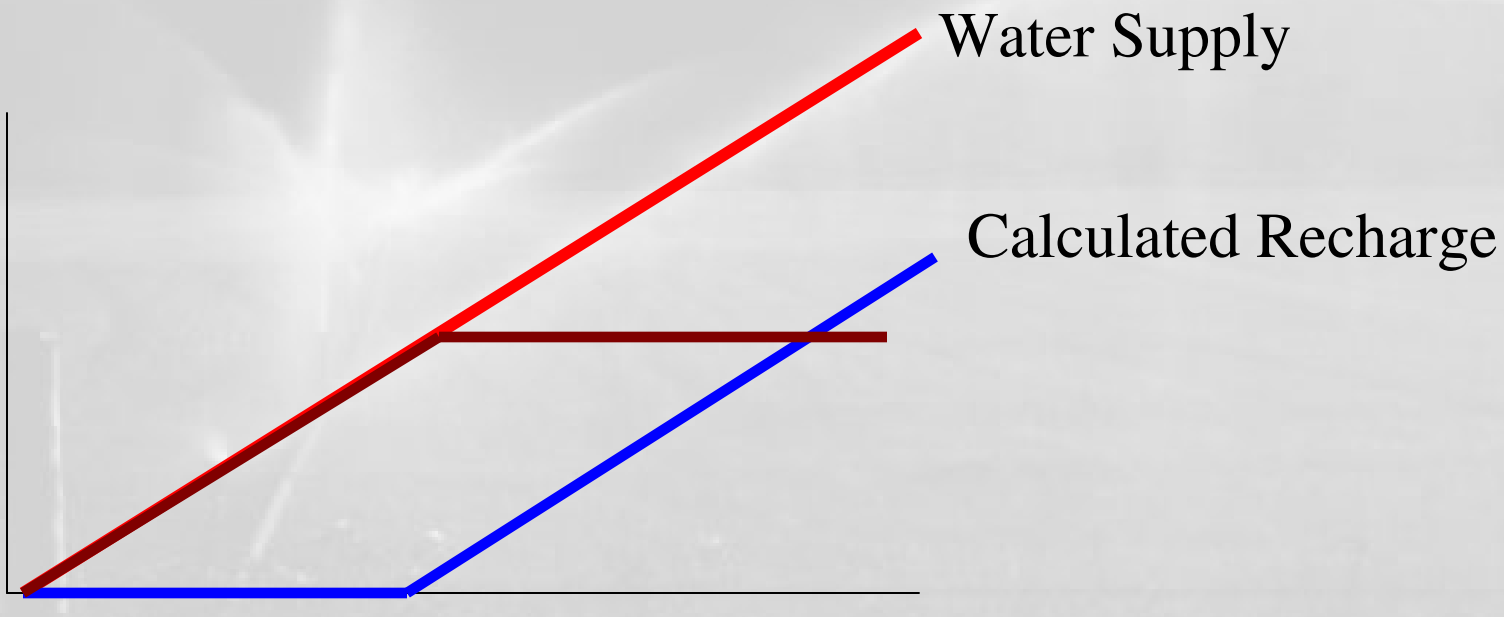
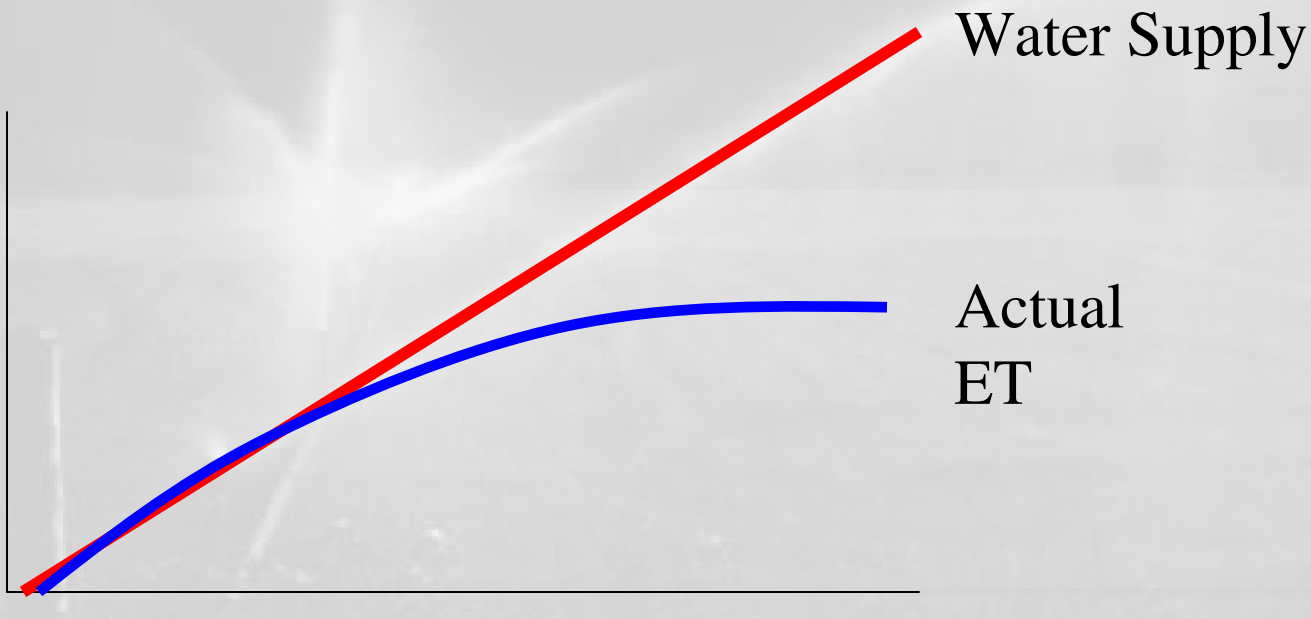


What is reality - SW only?



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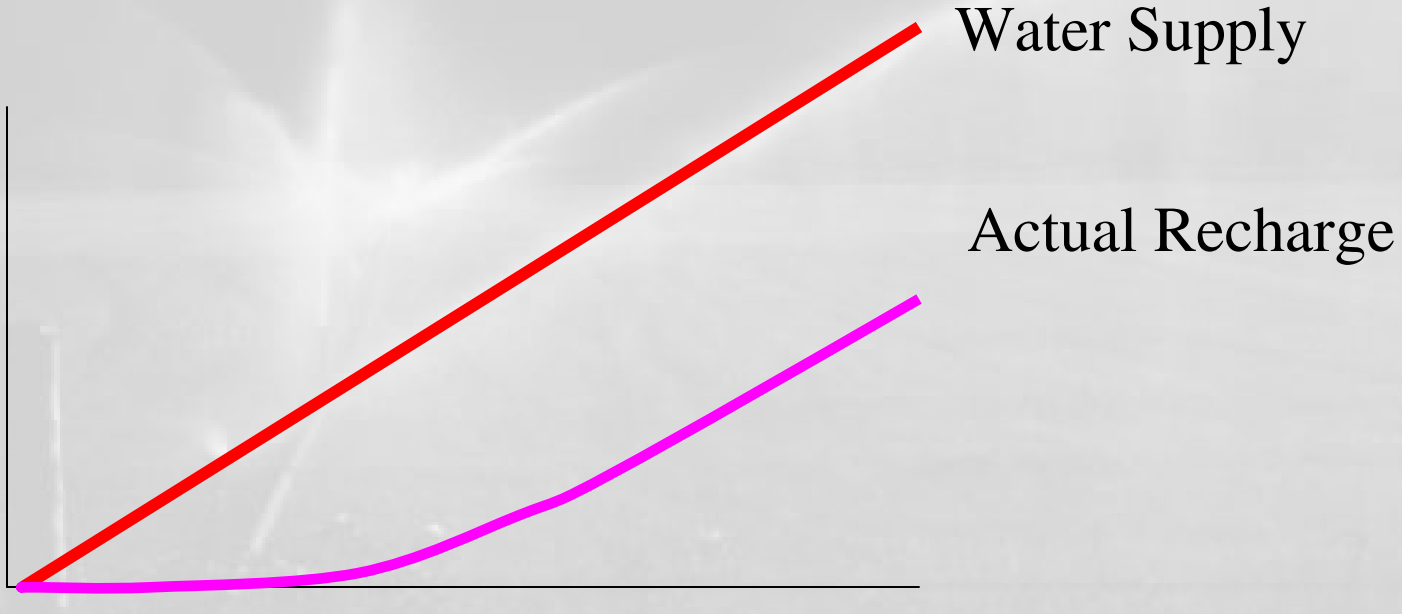

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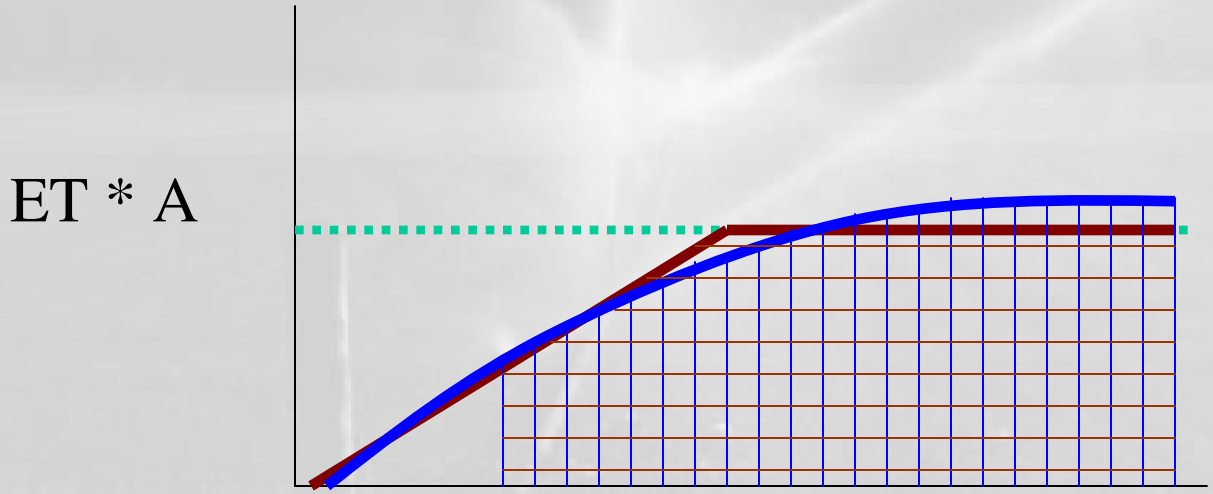
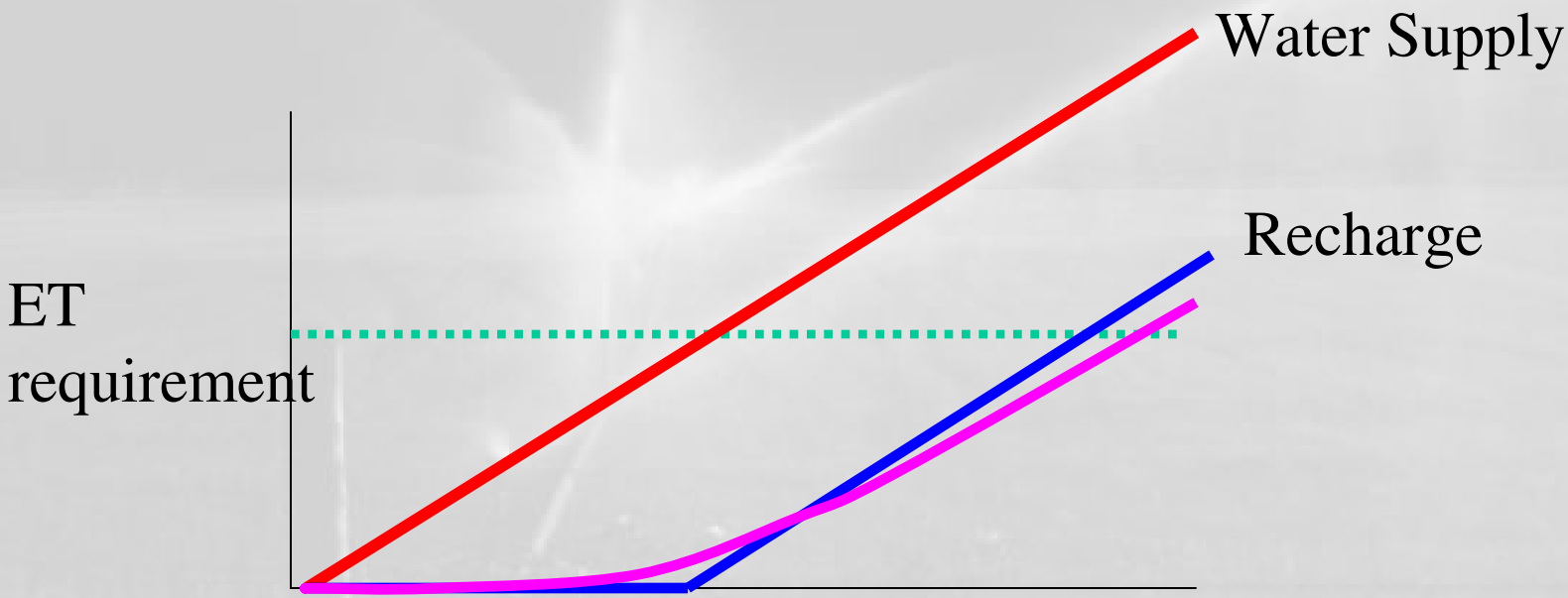


By the very construction of ET Adjustment Factors, the integrated areas under the curves will be equal.

How much difference does it make - SW only?



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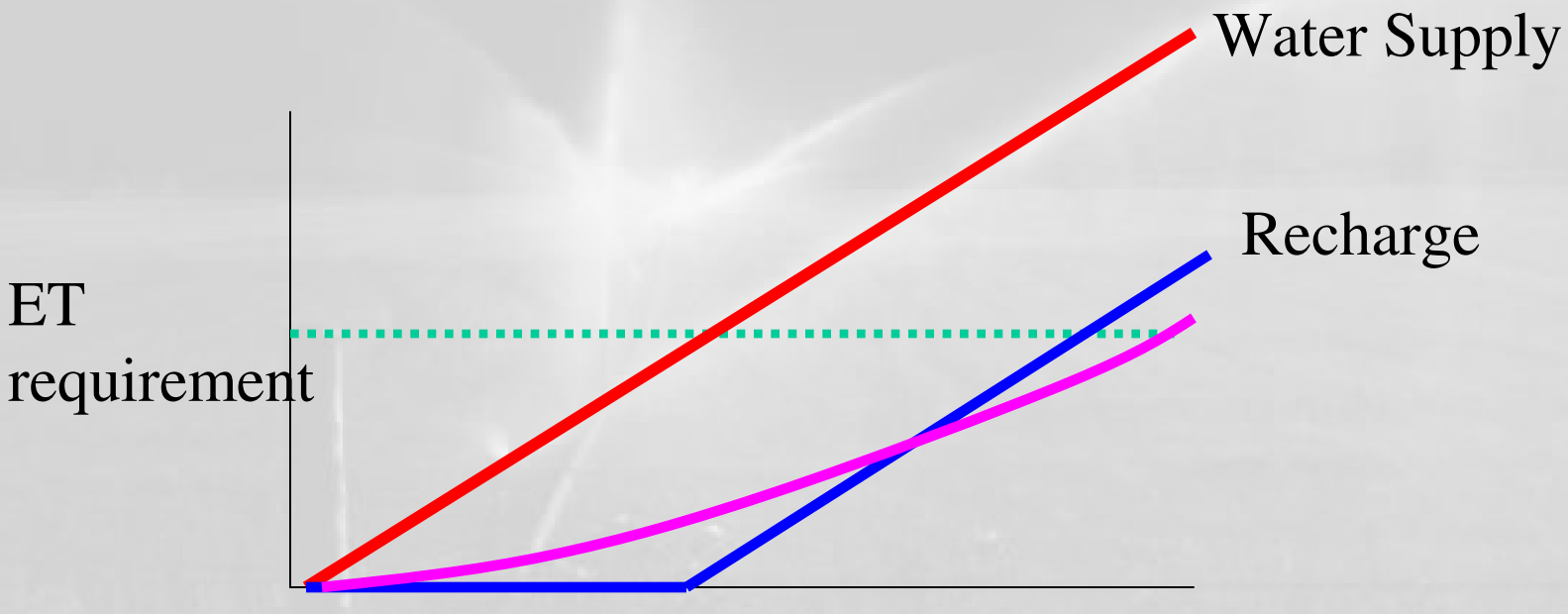
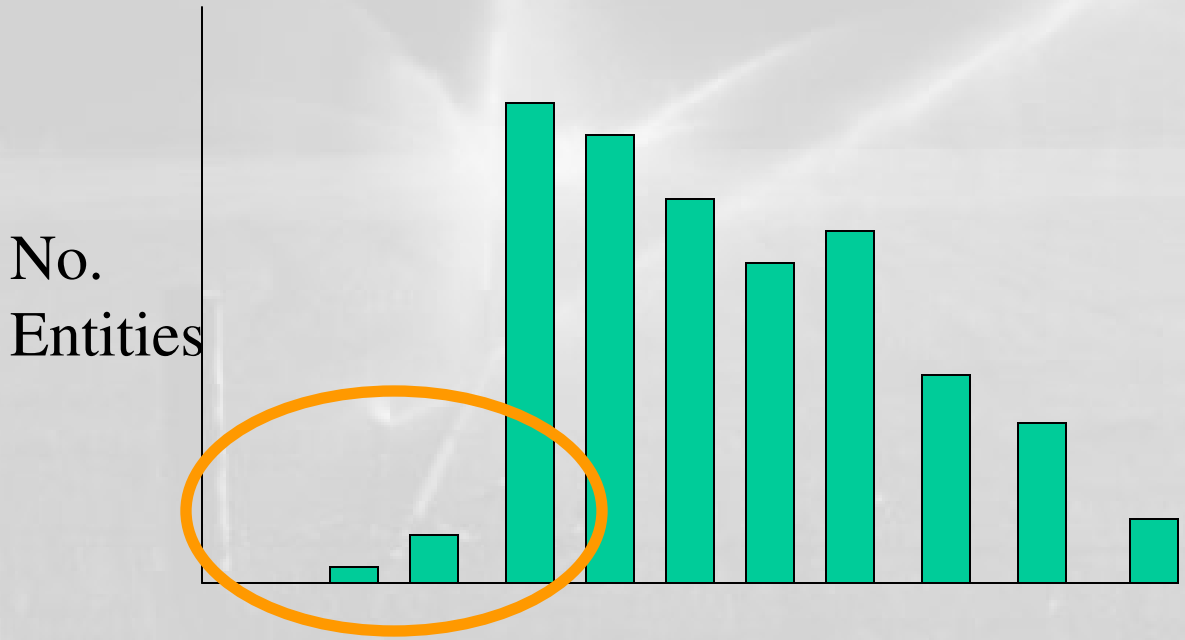


How often does it make a difference - SW only?



ESPAM1.1 conceptual model (mixed source):

In-field Recharge = ($P + D_h - R - ET*A$)

P	= precipitation
D_h	= field headgate delivery
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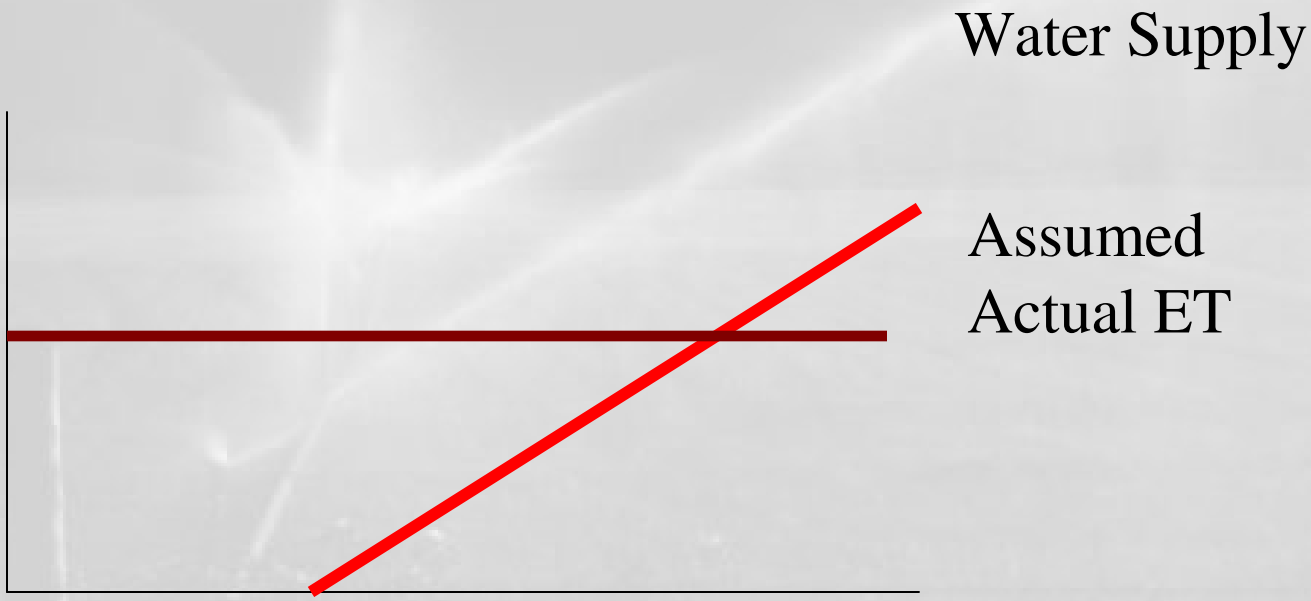
ET	= Evapotranspiration
A	= ET adjustment factor

ESPAM1.1 conceptual model (mixed source):



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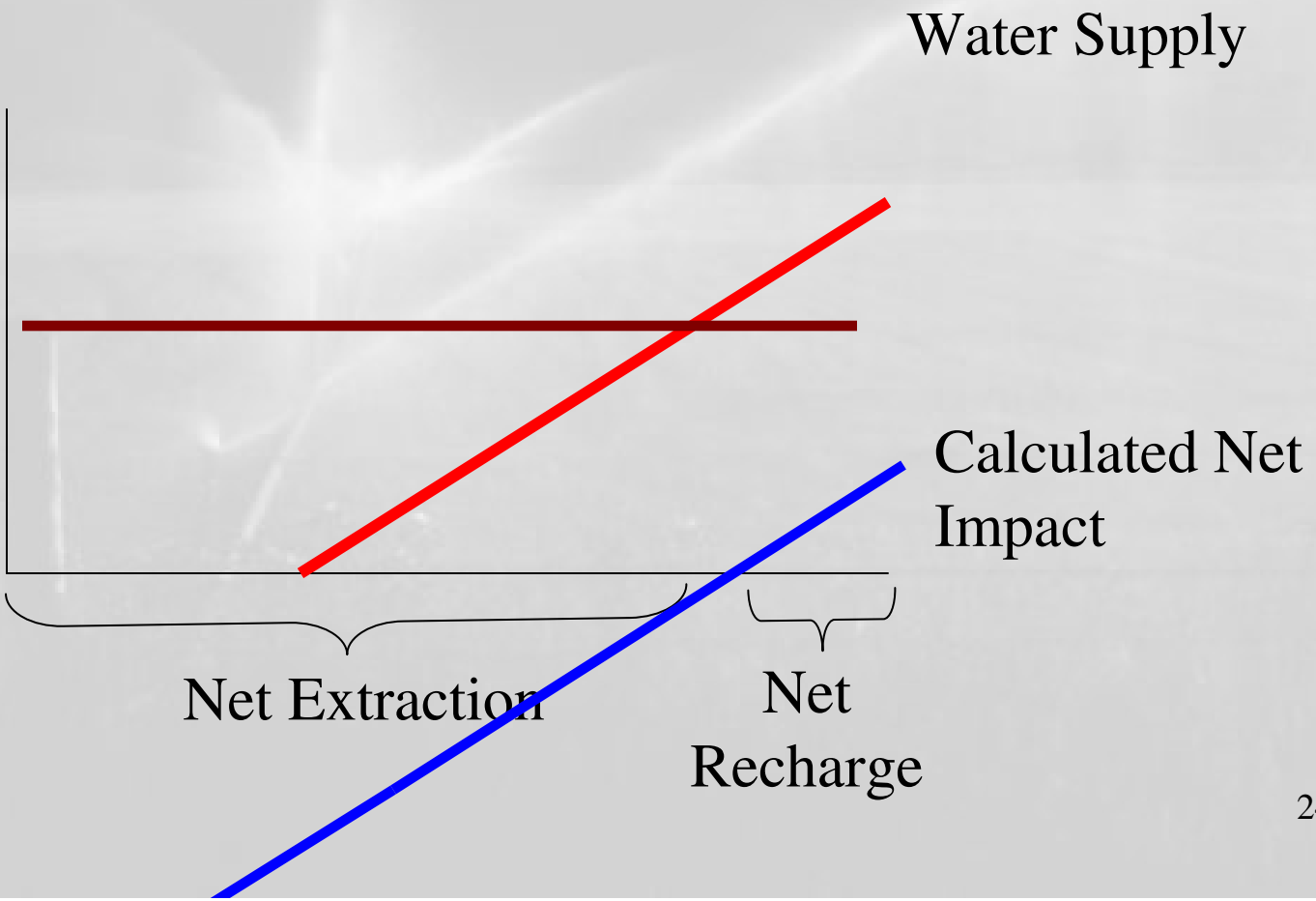

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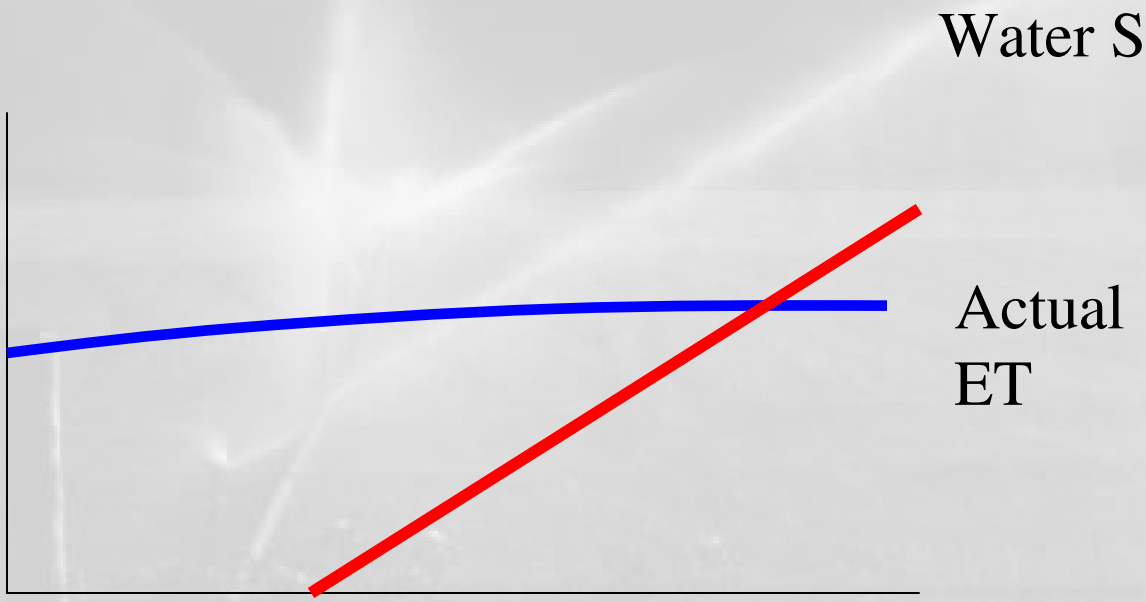

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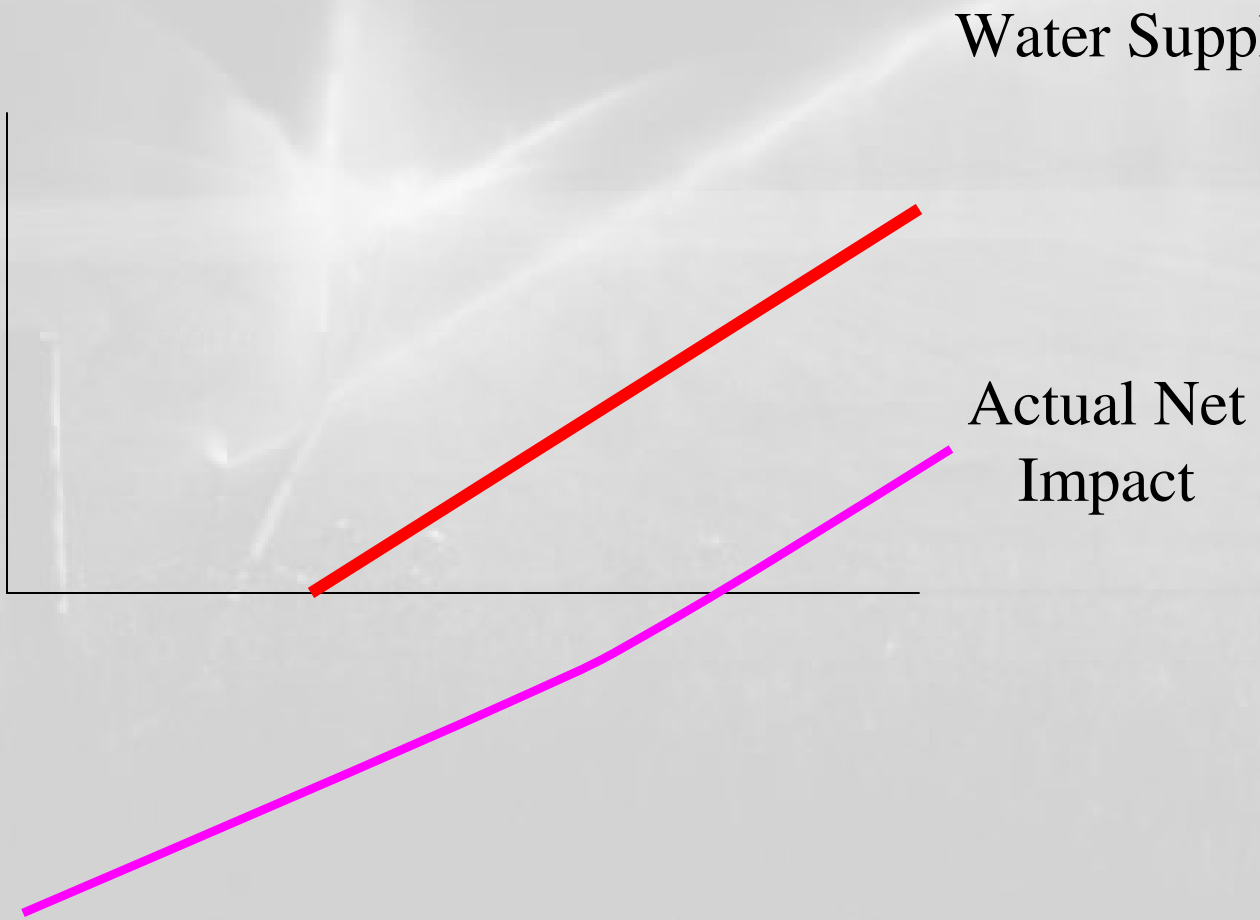

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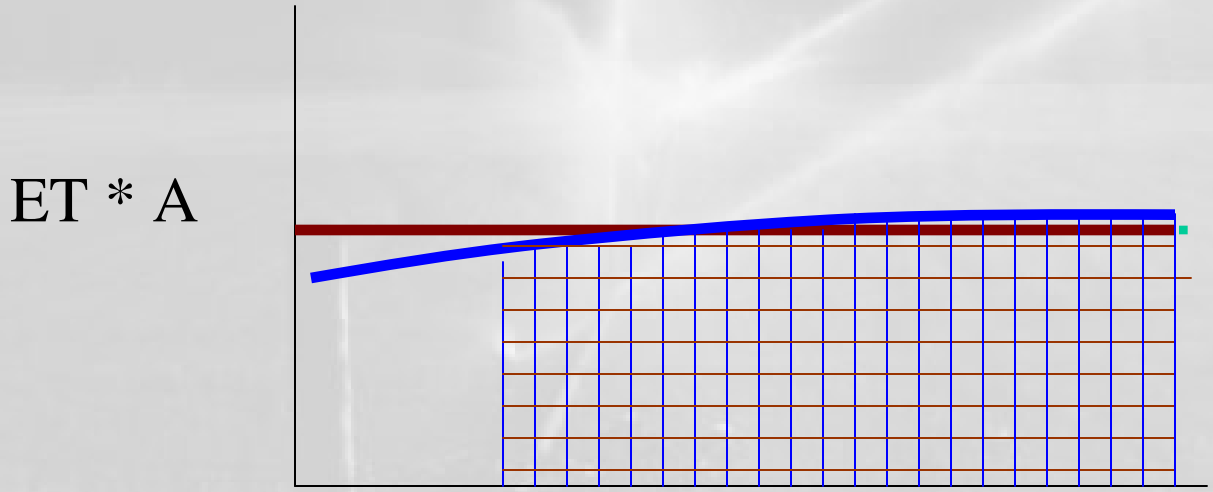

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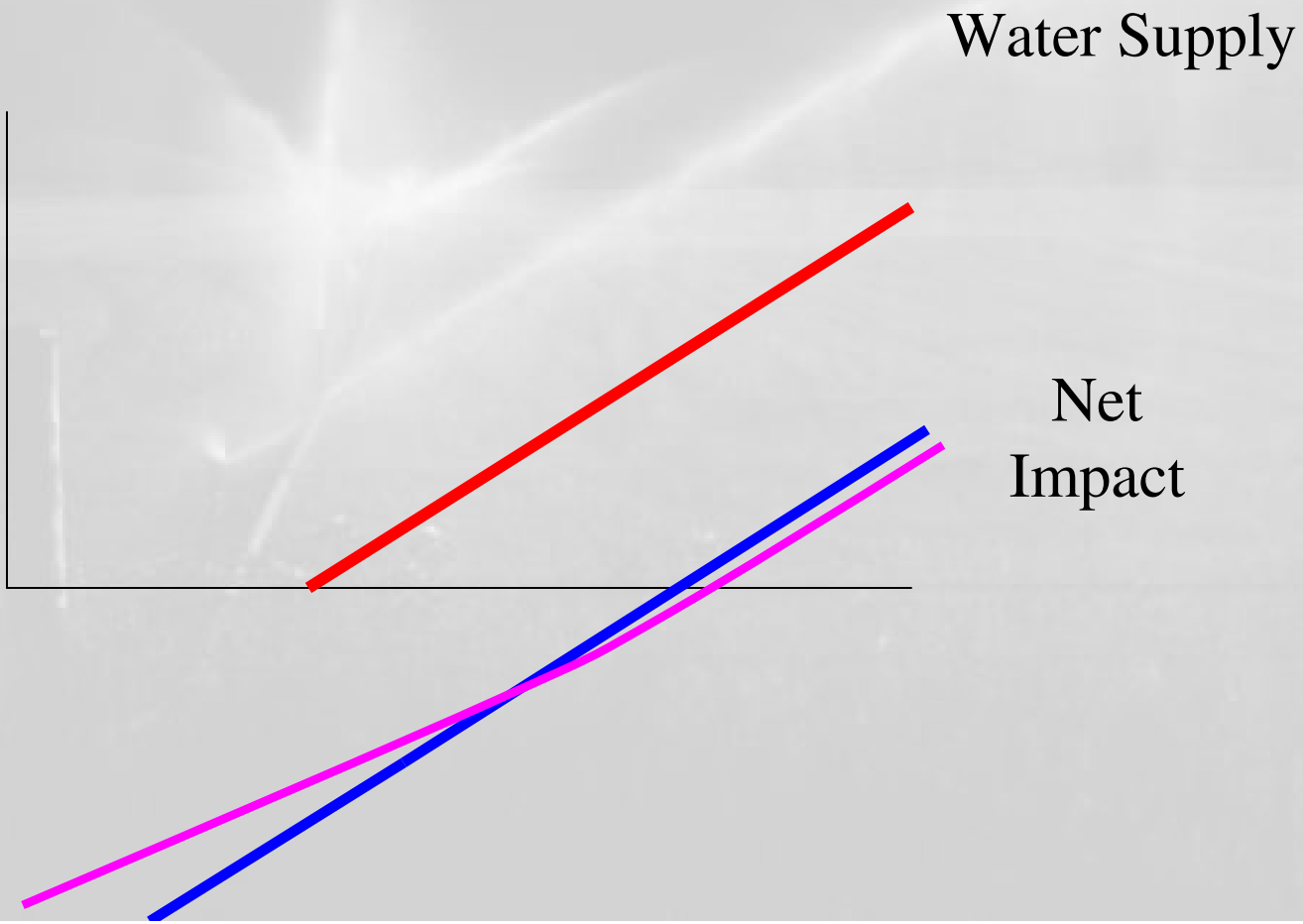

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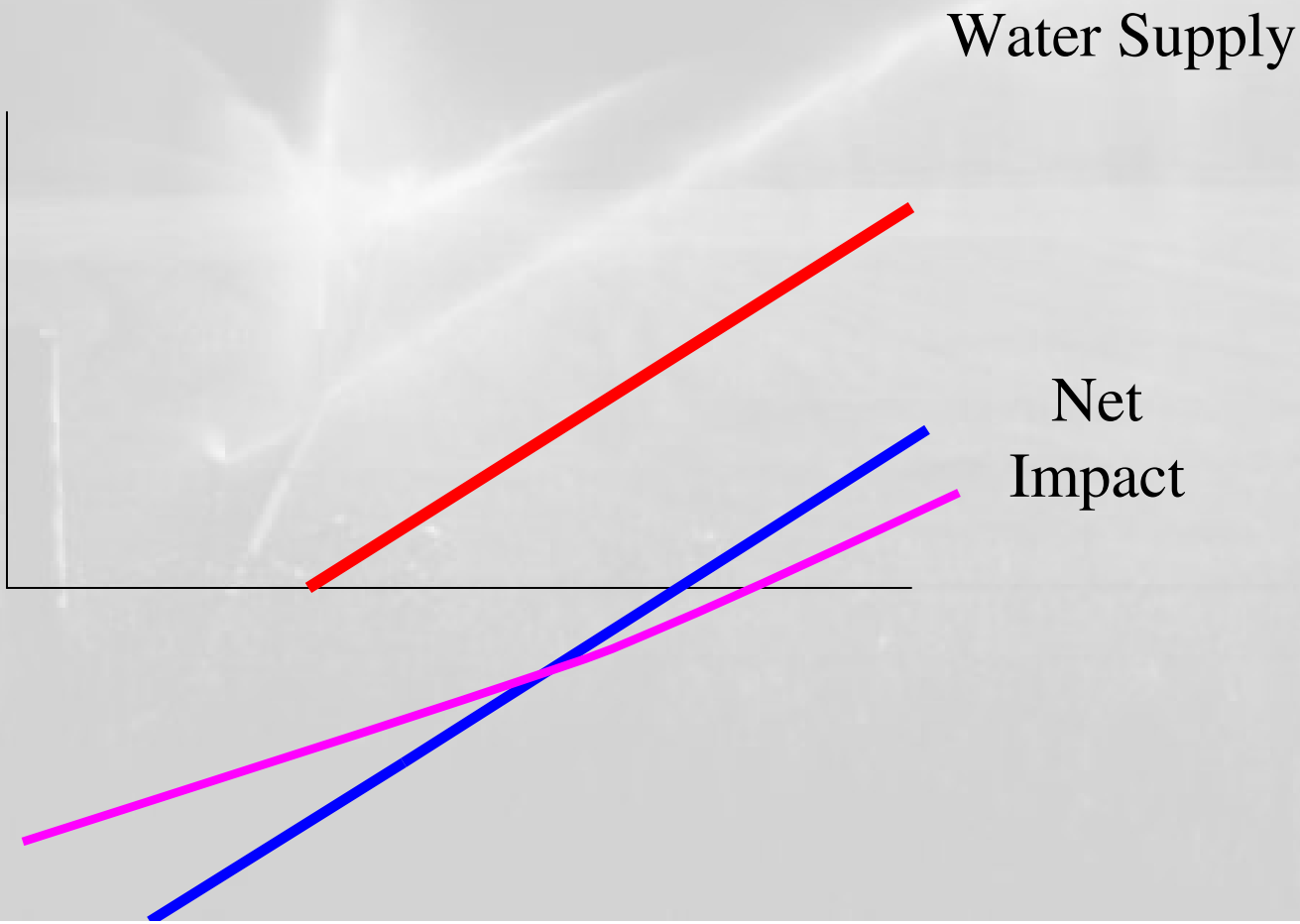


How often does it make a difference on mixed-source lands?

Bottom Line:

Avg. Model Net Effect = Avg. Actual Net Effect

if

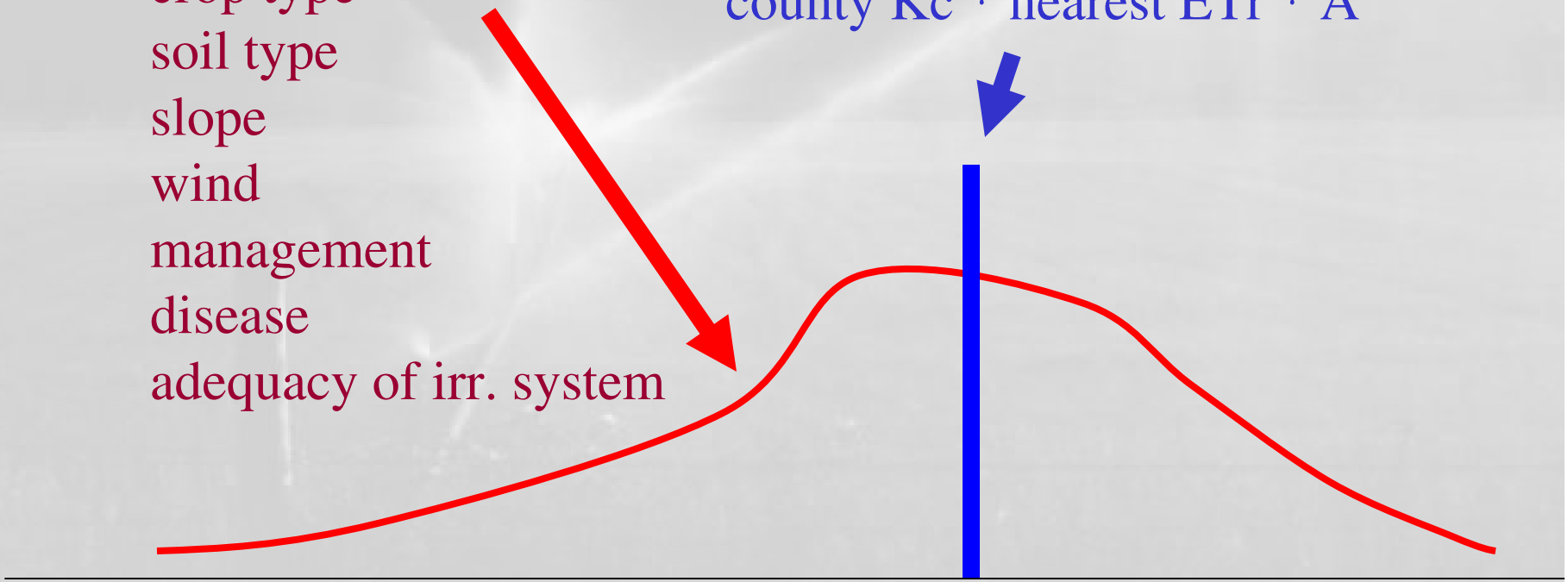
we get ET Adjustment Factor right.

There may be some distortion
in spatial distribution of recharge

For context, consider other spatial uncertainties in ET:

probability distribution:

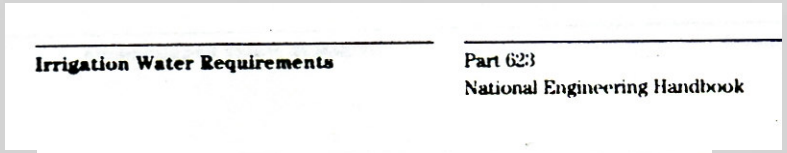
- crop type
- soil type
- slope
- wind
- management
- disease
- adequacy of irr. system



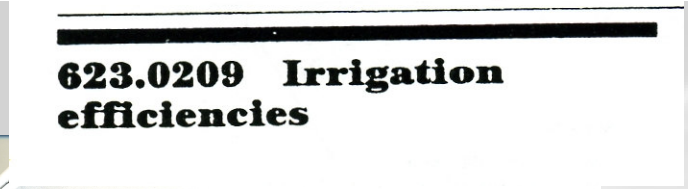
Is there something we can do?

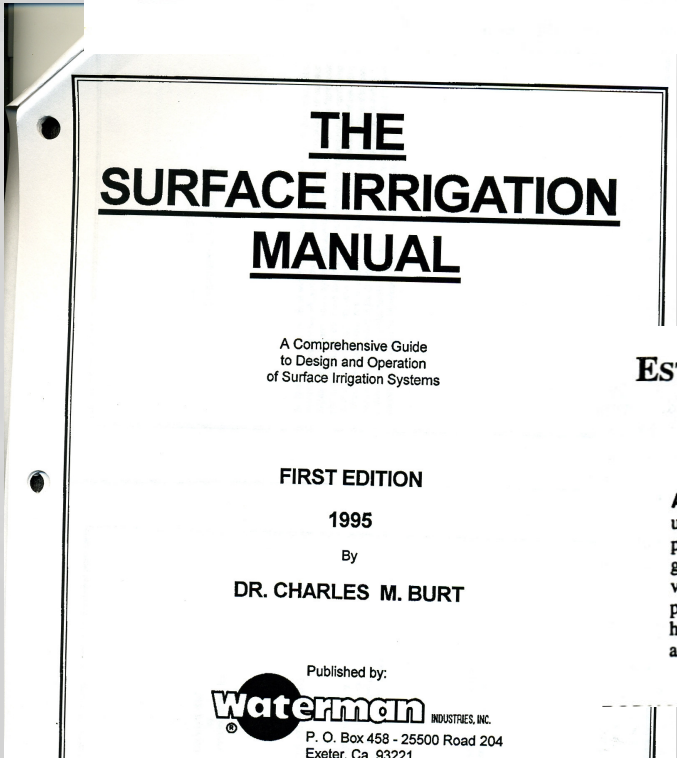
- Accept status quo
- Make minor revision
  - In-field Rech = Max ($P + D_h - R - ET*A$, X)
  - X to be defined by ESHMC
    - $0 < X < (P + D_h - R)$ ← ***Introduce Bias?***
- Make major revision
  - On-farm water budget study for sampling of farms
  - Modify algorithm

On-farm Water Budgets


Irrigation Water Requirements

Part 623
National Engineering Handbook


623.0209 Irrigation efficiencies


THE SURFACE IRRIGATION MANUAL

A Comprehensive Guide to Design and Operation of Surface Irrigation Systems

FIRST EDITION

1995

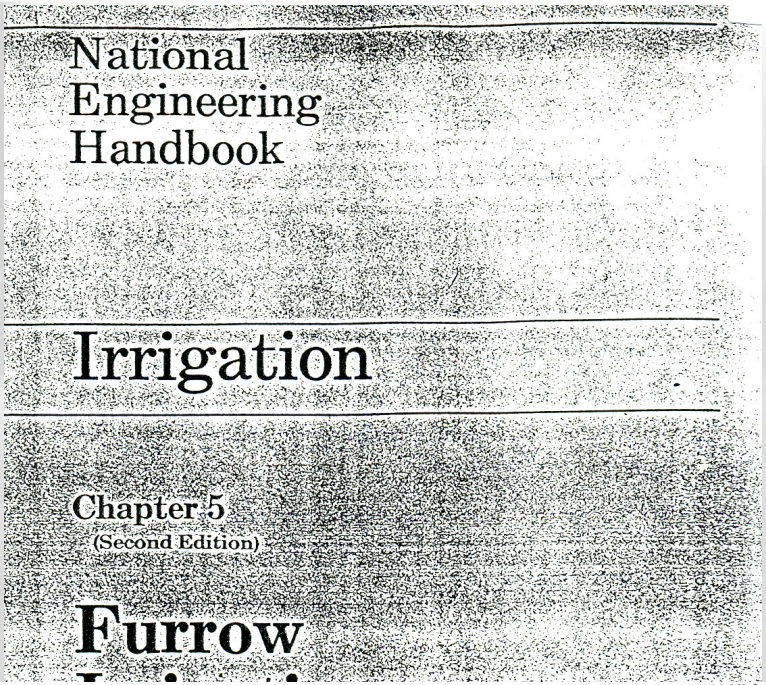
By

DR. CHARLES M. BURT

Published by:

Waterman INDUSTRIES, INC.

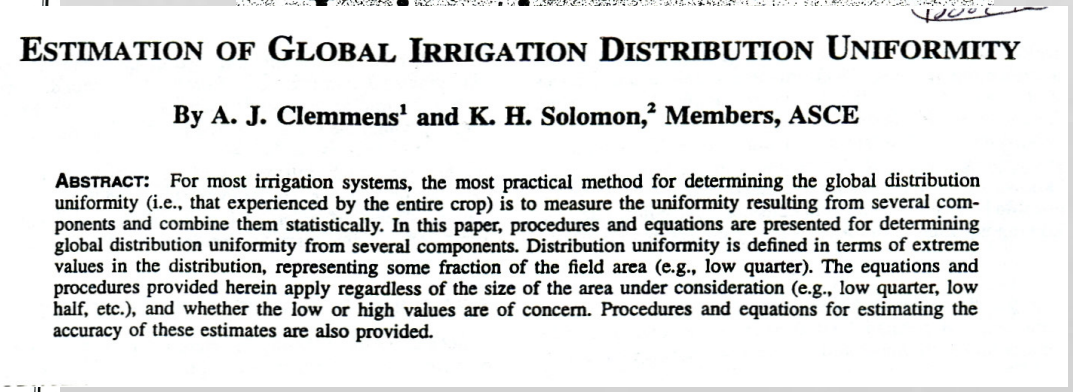
P. O. Box 458 - 25500 Road 204
Exeter, Ca. 93221


National Engineering Handbook

Irrigation

Chapter 5
(Second Edition)

Furrow


ESTIMATION OF GLOBAL IRRIGATION DISTRIBUTION UNIFORMITY

By A. J. Clemmens[1] and K. H. Solomon,[2] Members, ASCE

ABSTRACT: For most irrigation systems, the most practical method for determining the global distribution uniformity (i.e., that experienced by the entire crop) is to measure the uniformity resulting from several components and combine them statistically. In this paper, procedures and equations are presented for determining global distribution uniformity from several components. Distribution uniformity is defined in terms of extreme values in the distribution, representing some fraction of the field area (e.g., low quarter). The equations and procedures provided herein apply regardless of the size of the area under consideration (e.g., low quarter, low half, etc.), and whether the low or high values are of concern. Procedures and equations for estimating the accuracy of these estimates are also provided.

IRRIGATION PERFORMANCE MEASURES: EFFICIENCY AND UNIFORMI

Book 12

By C. M. Burt,[1] A. J. Clemmens,[2] T. S. Strelkoff,[3] K. H. Solomon,[4] R. D. Bliesner,[5] L. A. Hardy,[6] T. A. Howell,[7] Members, ASCE, and D. E. Eisenhauer[8]

ABSTRACT: It is essential to standardize the definitions and approaches to quantifying various irrigation performance measures. The ASCE Task Committee on Defining Irrigation Efficiency and Uniformity provides a comprehensive examination of various performance indices such as irrigation efficiency, application efficiency, irrigation sagacity, distribution uniformity, and others. Consistency is provided among different irrigation methods and different scales. Clarification of common points of confusion is provided, and methods are proposed whereby the accuracy of numerical values of the performance indicators can be assessed. This issue has two companion papers that provide more detailed information on statistical distribution uniformity and the accuracy of irrigation efficiency estimates.

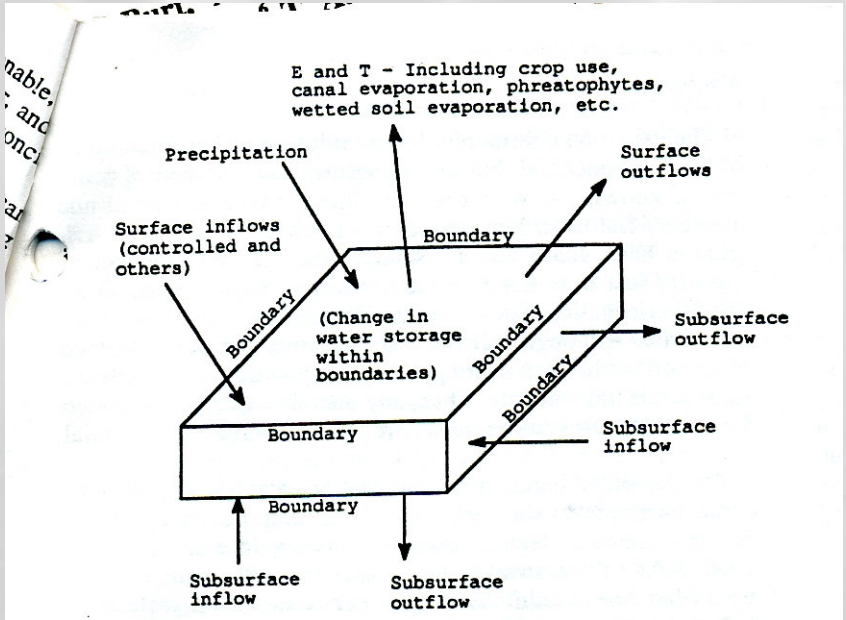


FIG. 2. Components of Simplified Water Balance within Defined Boundaries for Specified Time Interval

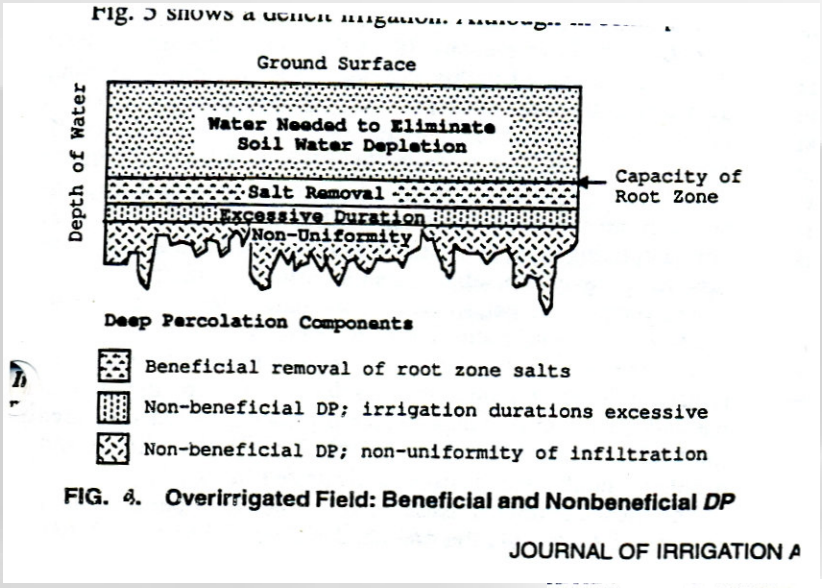


FIG. 4. Overirrigated Field: Beneficial and Nonbeneficial *DP*

JOURNAL OF IRRIGATION A

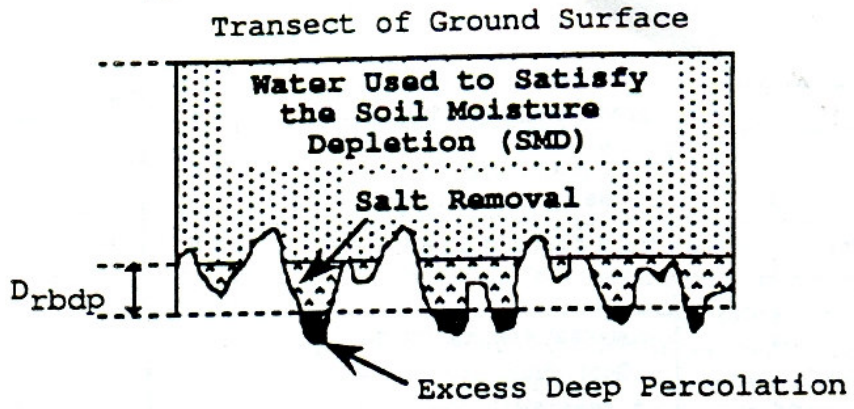


FIG. 5. Deficit Irrigation Nonbeneficial *DP*

Modified Algorithm?

$$R = B_0 + B_1 X_1 + B_2 X_2 \ldots\ldots$$

DISCUSSION

28 Oct 2008